


47th Annual
ENVIRONMENTAL
SHOW OF THE SOUTH
May 16-18, 2018

Construction and Demolition Recycling in the US: Current State of Practice

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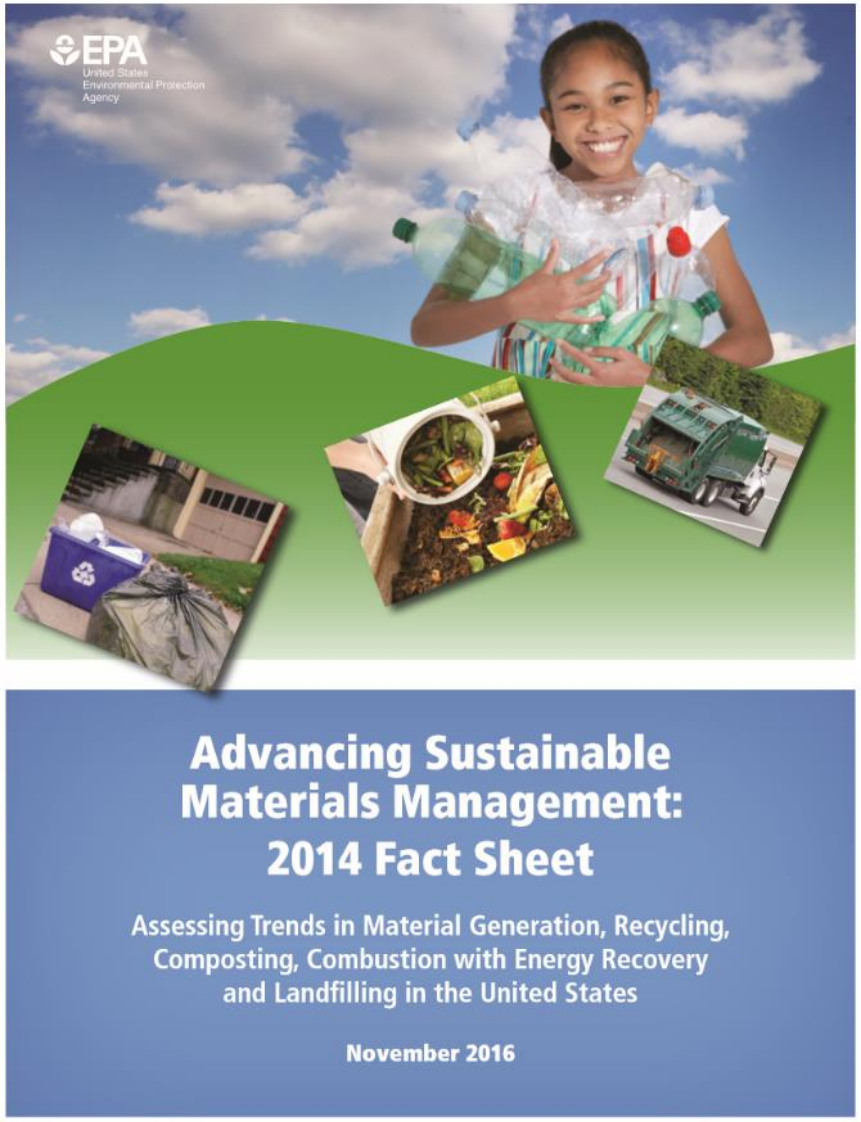
Sustainable Materials Management



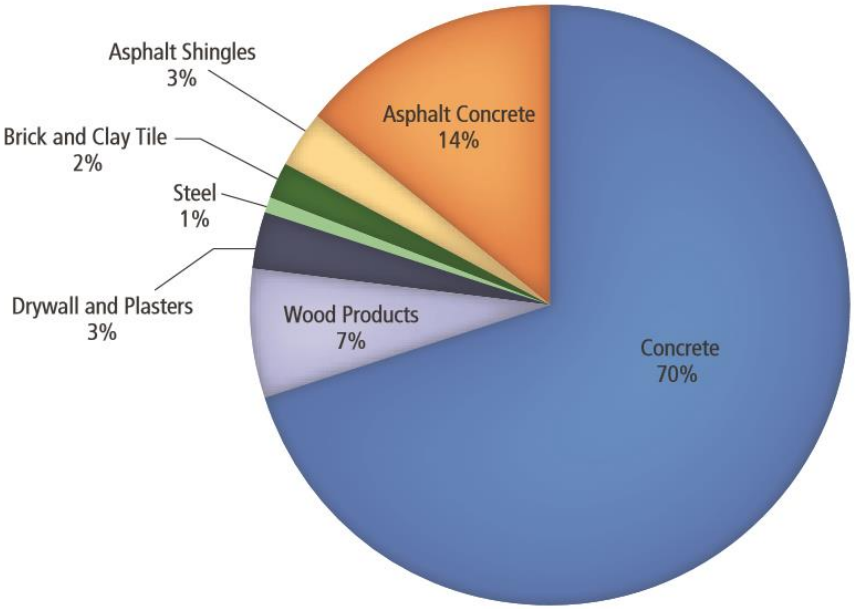
CAT
320C
CAT


Planter
Mix


Concrete
Mix
Recycled



2014 US EPA Estimate:
534 million tons C&D generated in US

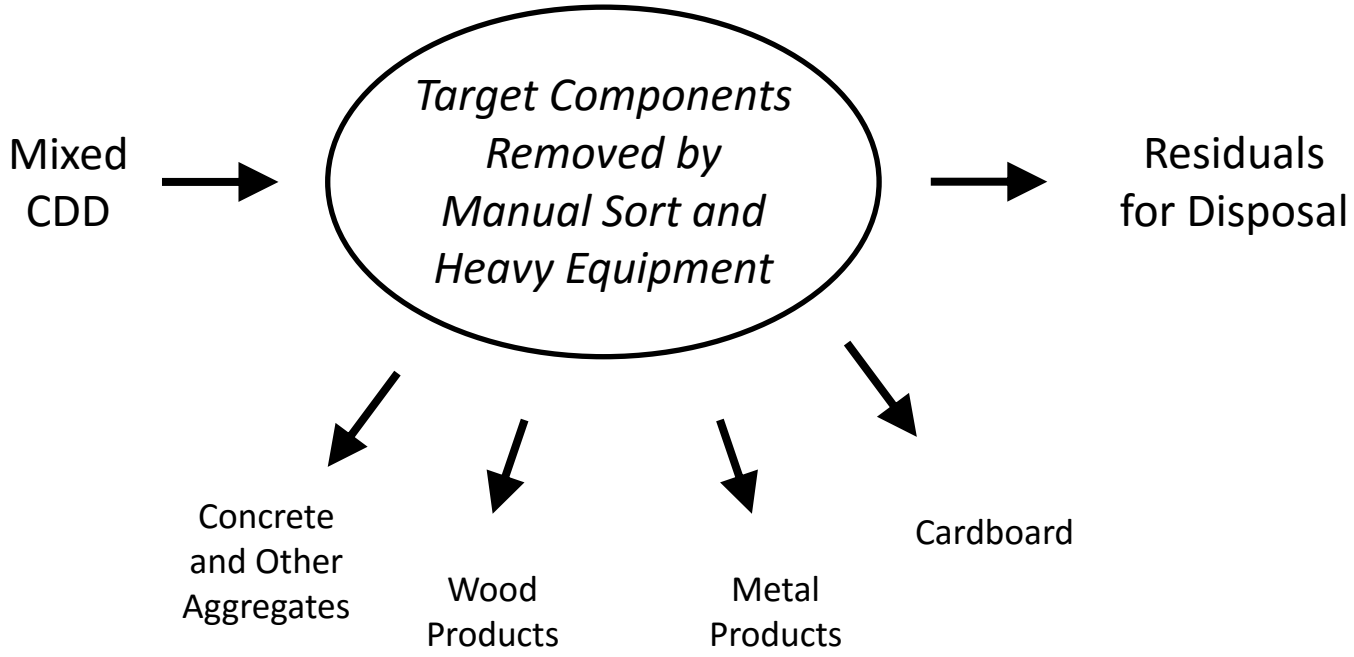


C&D Management Options

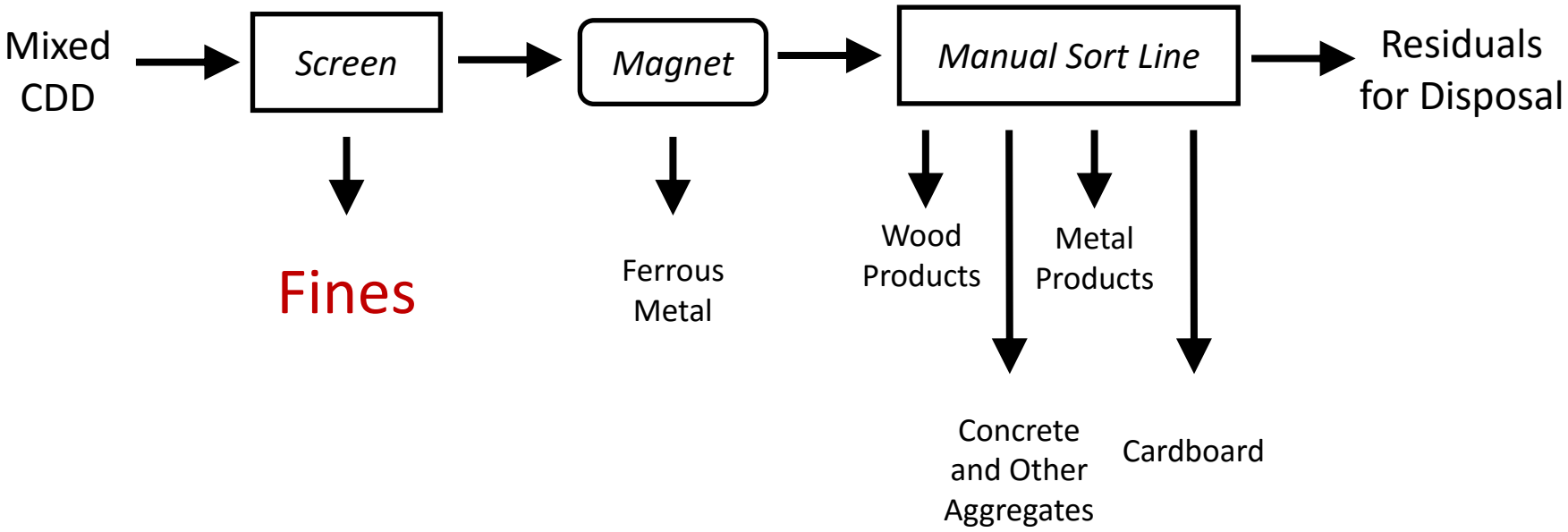
- Bulk aggregate operations
  - Mobile and stationary concrete crushers
- Mixed C&D recycling operations
  - Job site separation
  - Deconstruction
  - On-site Processing
  - Mixed C&D processing facilities

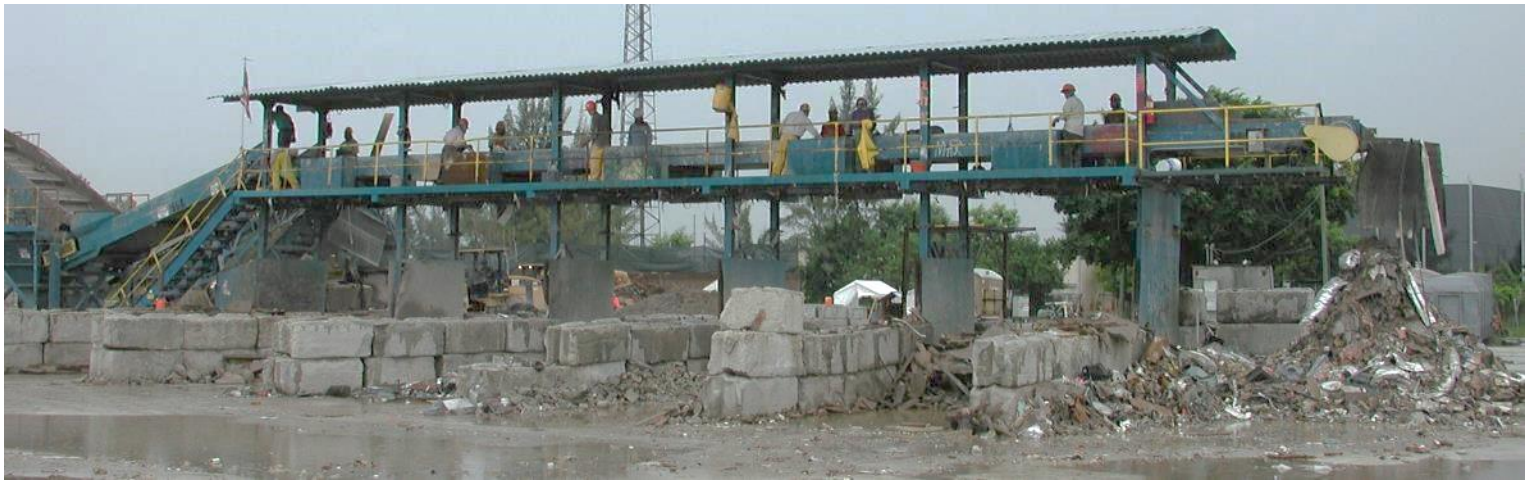

Deconstruction

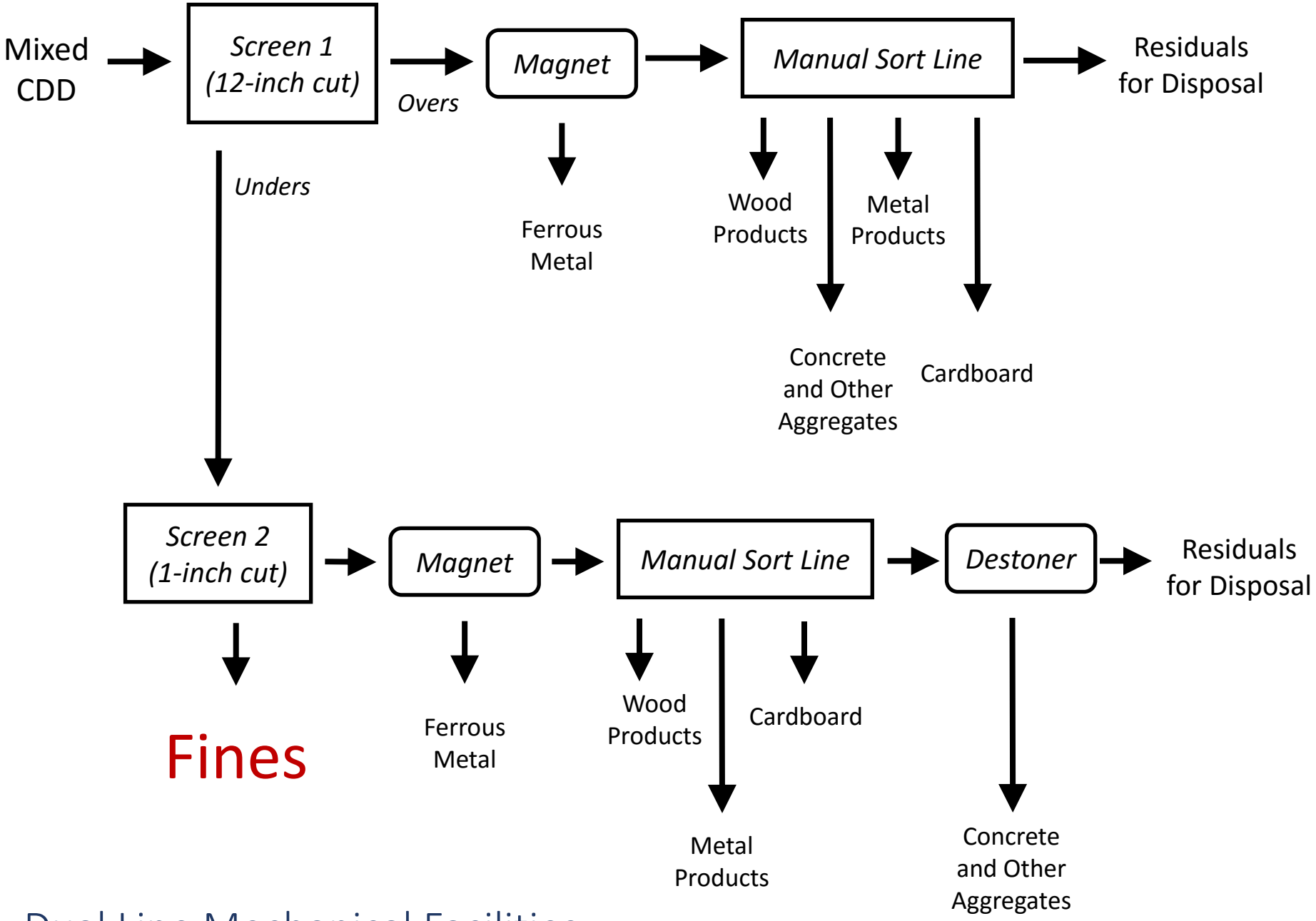
Dump and Pick Facilities



Single Line Mechanical Facilities







Dual Line Mechanical Facilities

Dual Line Mechanical Facilities


KOMATSU


KOMATSU


SWS
2831


Fines


Wood
Fines


Picking Line
Fines


2
EXIT
EXIT
CARDBOARD
CARDBOARD


METALS

Concrete Markets

Major markets for portland cement concrete (often with minor amounts of brick, tile and other masonry products):

→ Replacement of natural construction aggregates, particularly as road base or similar.

→ In some cases used as clean fill material.

→ Markets as concrete or pavement aggregate still somewhat limited.

Asphalt Concrete Markets

Major markets for asphalt concrete:

→ Heavily recycled into the manufacturer of new hot mix asphalt (HMA) pavement.

→ Recycling rate > 90%

NAPA
NATIONAL ASPHALT PAVEMENT ASSOCIATION

Asphalt Shingle Markets

Major markets for asphalt shingles:

→ Bitumen and aggregate source for the manufacture of new HMA.

→ Replacement levels of 5% or 10%.

→ Biggest challenge is regulatory (and economic hurdle) of asbestos testing.

→ Tied to asphalt prices.

Wood Markets

Major markets for C&D Wood:

→ Fuel

→ Landscape mulch

→ Challenges:

- → Fluctuating boiler fuel prices
- → Issues with impurities
  - → Lead paint
  - → Treated wood
  - → Engineered wood

Gypsum Drywall Markets

Major markets for gypsum drywall:

- → New drywall
- → Agriculture/soil amendment
- → Minor (cement kiln, construction products)
- → Challenges:
  - → Cost competition with other gypsum sources
  - → Separation from other waste stream components

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NEW WEST GYPSUM RECYCLING

We ARE Gypsum Recycling

Scrap drywall to new drywall

Agricultural Products

USA Gypsum®

Pulverized gypsum for land application

Refuse Derived Fuel

There is a growing recognition that a market for some C&D materials is as a fuel substitute (e.g., for cement kilns).

Issues:

→ Chlorinated plastics (PVC)
→ Competition with other RDF sources
→ Regulatory requirements for facilities burning RDF

C&D Debris Fines

Major markets for C&D fines:
→ Landfill cover
→ Non-structural soil fill
→ Soil amendments

Challenges:
→ Trace chemical constituents
→ Gypsum and H_2S
→ Low strength properties

CDRA C&D Benefits White Paper

- The benefits whitepaper is being updated
- Benefits
  - Landfill capacity savings
  - Energy savings
  - Life cycle environmental benefits
  - Job creation
  - Impact on local economies

https://cdrecycling.org/

The Benefits of Construction and Demolition Materials Recycling in the United States

A CDRA White Paper

April 2017
Version 1.1

Prepared for the Construction & Demolition Recycling Association by
The Department of Environmental Engineering Sciences,
Engineering School of Sustainable Infrastructure and Environment, University of Florida

Timothy Townsend, Principal Investigator; Malak Anshassi, Student Assistant

Executive Summary

In the US, Construction and demolition materials (C&D) are consider one of the largest components of the solid waste stream, which makes them ideal candidates for the recycling industry. A main motivation to recycle this material is the economic benefit, however other motivators include avoidance of landfill disposal thus saving acres of land. Relative to landfilling, C&D materials recycling results in a greater job creation and industrial activity, and a greater degree of environmental protection, a smarter use of natural resources, energy savings, and a net decrease in greenhouse gas emissions. This report summarizes an effort conducted to assess the benefits of the C&D recycling industry in the US relative to 2014. The numerical estimates presented herein were determined using available C&D industry data from the literature, additional information surveyed from the C&D recycling community, and the authors' professional experience.

C&D generation statistics are not rigorously tracked in the US, and predictions of the amount of C&D landfilled and recycled vary dramatically. For this analysis, the amount of C&D generated in the US in 2014 was estimated at approximately 430 million tons. The C&D consists of approximately 64 million tons of mixed C&D, 290 million tons of bulk aggregate (primarily concrete), and 76 million tons of reclaimed asphalt pavement (RAP). About 73% of this waste stream was projected as being recovered and put to beneficial use by the C&D recycling industry (corresponding to a 37% recycling rate for mixed C&D, an 85% recycling rate for bulk aggregate, and an over 99% recycling rate for RAP). The area of landfill avoided by recycling this amount of C&D is equivalent to over 5,500 acres (at a waste depth of 50 ft).

The energy savings and greenhouse gas (GHG) emissions avoidance as a result of recycling C&D components instead of landfilling them was assessed using emission and energy factors developed by the US Environmental Protection Agency. In 2014, the estimated magnitude of GHG emissions offset corresponded to taking 10.25 million passenger cars off the road for an entire year. The energy savings resulting from C&D recycling was equivalent to over 4.94 gallons of gasoline consumed.

Using industry survey results and the waste recycling projections, the C&D recycling industry was projected to be responsible for the direct support of 27,900 jobs in the US in 2014. Facility owners have invested over $6.6 billion in the development and construction of C&D recycling infrastructure. The direct annual output (revenue) of the C&D recycling industry was estimated to be approximately $9.9 billion, and when considering indirect and induced economic output, the industry represented an over $23 billion contribution.

CDRA Construction & Demolition Recycling Association

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Benefits of C&D Recycling

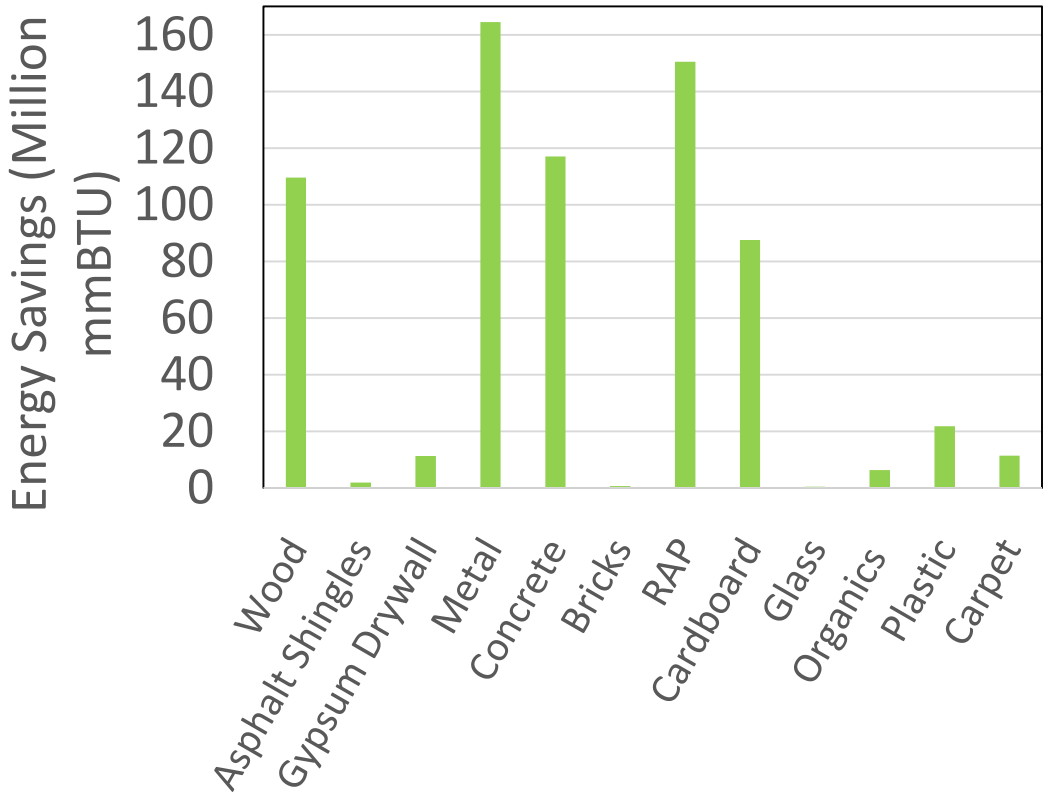
Energy Savings

- Waste recycling estimates were used along with WARM energy factors to estimate energy savings from C&D recycling.

All of the asphalt recycled in 2014 resulted in an energy savings equivalent to 117 million barrels of oil

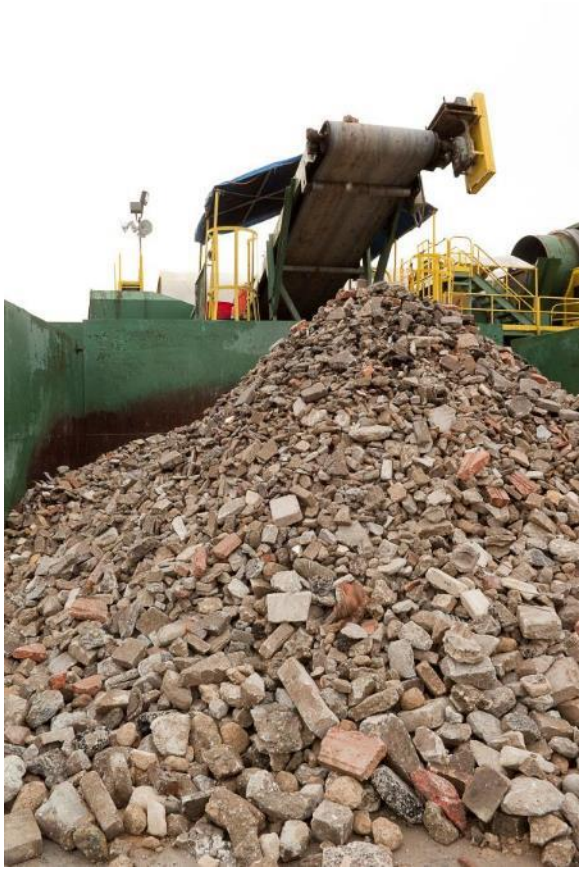
Energy Savings through C&D Recycling

Material	Energy Savings (Million mmBTU)
Wood	109
Asphalt Shingles	1.91
Gypsum Drywall	11.2
Metal	164
Concrete	117
Bricks	0.67
RAP	150
Cardboard	87.5
Glass	0.40
Organics	6.25
Plastic	21.7
Carpet	11.3
Total	**682**



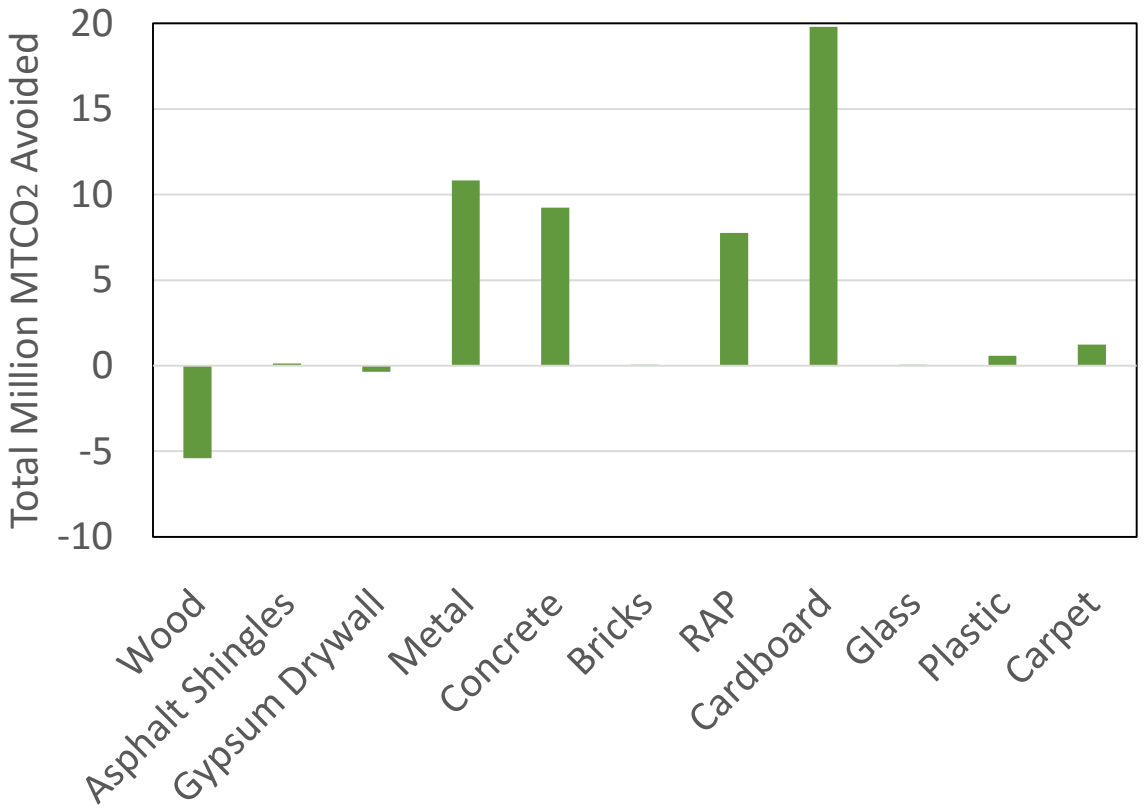
Greenhouse Gas Emissions

- Waste recycling estimates were used along with WARM GHG emission factors to estimate GHG offsets resulting from C&D recycling.



GHG Offsets through C&D Recycling

Material	Total Million $MTCO_2E$ Avoided
Wood	-5.41
Asphalt Shingles	0.14
Gypsum Drywall	-0.35
Metal	10.8
Concrete	9.24
Bricks	0.05
RAP	7.76
Cardboard	19.8
Glass	0.05
Plastic	0.58
Carpet	1.24
Total	**43.9**



Landfill Capacity Savings

- Assume 430 millions tons of C&D recycled
- Assume density of 1,200 pcy, 2,200 pcy, and 2,000 pcy for mixed C&D, bulk aggregate, and RAP, respectively
- Assume landfill depth of 50 ft
- Landfill area saved in one year → 5,534 acres

Recycled Material	Million Tons	Acres Saved*
Mixed C&D	63.4	1,310
Bulk Aggregate	290	3,277
RAP	76.3	947
Total	**430**	**5,534**

Job Creation

- Job statistics from both bulk aggregate and mixed C&D processing facilities have been collected.

Recycled Material	Million Tons	Jobs per Million Tons of Annual C&D Recycled	Thousands Jobs Produced
Mixed C&D	63.4	233	14.8
Bulk Aggregate	290	45.0	13.3
Total	**430**		**27.9**

Direct and Indirect Economic Benefit

- Economics statistics from both bulk aggregate and mixed C&D processing facilities have been collected.

Recycled Material	Million Tons	Capital Expenditures (Billion)	Direct Revenue (Billion)	Direct & Indirect Revenue (Billion)	Direct, Indirect,& Induced Revenue (Billion)
Mixed C&D	63.4	$3.45	$3.42	$5.82	$8.09
Bulk Aggregate	290	$3.17	$6.51	$11.1	$15.3
Total	**430**	**$6.63**	**$9.94**	**$16.9**	**$23.4**

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Construction & Demolition Recycling Association

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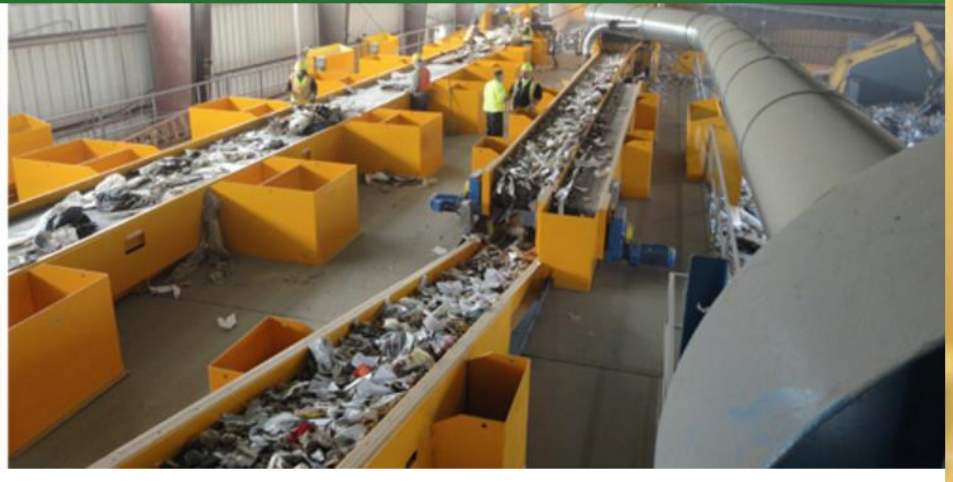

Welcome to the CDRA

The **Construction & Demolition Recycling Association** (CDRA) promotes and defends the environmentally sound recycling of the more than 325 million tons of recoverable construction and demolition (C&D) materials that are generated in the United States annually. These materials include aggregates such as concrete, asphalt, asphalt shingles, gypsum wallboard, wood and metals.

The CDRA represents a diverse group of member companies and agencies from the many C&D materials recycling disciplines and industry specialties active in the United States and other countries.

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